AMENDMENTS TO THE CLAIMS

Claim 1 (Currently Amended) A deinterlacing method for converting an interlaced image into a progressive image, said method comprising ~~steps of~~:

performing a filtering process to pixels of at least one of three fields, a deinterlacing target field to be subjected to a deinterlacing process and forward and backward fields of the deinterlacing target field within the interlaced image~~, thereby generating~~ so as to generate an interpolation pixel for the deinterlacing target field;

measuring a quantity of motion of the deinterlacing target field; and

changing characteristics of the filtering based on ~~the basis of~~ the quantity of the motion measured in said measuring of the quantity of motion;~~.~~

wherein a filter which is used in said performing of the filtering process so as to generate the interpolation pixel has characteristics of extracting vertical low frequency components of the deinterlacing target field, and extracting vertical high frequency components of the forward and backward fields of the deinterlacing target field.

Claim 2 (Cancelled)

Claim 3 (Currently Amended) The deinterlacing method of Claim 1, wherein in ~~the step of generating~~ said performing of the filtering process so as to generate the interpolation pixel, pixels in the deinterlacing target field or peripheral fields, which are in the same horizontal position as that of a position to be interpolated, are subjected to the filtering process.

Claim 4 (Currently Amended) The deinterlacing method of Claim 1, wherein in ~~the step of~~said measuring of the quantity of the motion, the quantity of the motion is obtained from a difference between the deinterlacing target field or a frame including the deinterlacing target field, and ~~other~~ another field or frame.

Claim 5 (Currently Amended) The deinterlacing method of Claim 1, wherein in ~~the step of~~ said measuring of the quantity of the motion, the quantity of the motion is obtained from a difference between the pixels which are used when the filtering process

is performed in ~~the step of generating~~ said performing of the filtering process so as to generate the interpolation pixels.

Claim 6 (Currently Amended) The deinterlacing method of Claim 5, wherein in ~~the step of~~ said measuring of the quantity of the motion, the quantity of the motion is obtained from a difference between pixels which are included in the forward and backward fields of the deinterlacing target field~~,~~ from among the pixels which are used when the filtering process is performed in ~~the step of generating~~ said performing of the filtering process so as to generate the interpolation pixels.

Claim 7 (Currently Amended) The deinterlacing method of Claim 1, wherein in ~~the step of~~ said changing of the characteristics of the filtering, the characteristics of the filtering are changed so that gain of components from the forward and backward fields of the deinterlacing target field is reduced as the quantity of the motion measured in said measuring of the quantity of motion is increased.

Claim 8 (Currently Amended) The deinterlacing method of Claim 1, wherein in ~~the step of~~ said changing of characteristics of the filtering, the characteristics of the filtering are changed so that gain of components from the forward and backward fields of the deinterlacing target field is reduced to zero when the quantity of the motion measured in said measuring of the quantity of motion is large.

Claim 9 (Currently Amended) A deinterlacing apparatus for converting an interlaced image into a progressive image, said apparatus comprising:

a frame memory for storing the interlaced image;

a filter unit for receiving, from said frame memory, a deinterlacing target field to be subjected to a deinterlacing process and one or both of forward and backward fields of the deinterlacing target field within the interlaced image, ~~from the frame memory,~~ and performing a filtering process to pixels of at least one of the received fields~~, thereby generating~~ so as to generate an interpolation pixel for the deinterlacing target field;

a difference operation unit for measuring a quantity of motion of the deinterlacing target field; and

a filter coefficient setting unit for changing characteristics of ~~the~~ said filter unit based on ~~the basis of~~ the quantity of the motion measured by ~~the~~ said difference operation unit;

wherein said filter unit is operable to extract vertical low frequency components of the deinterlacing target field, and to extract vertical high frequency components of the forward and backward fields of the deinterlacing target field.

Claim 10 (Currently Amended) A deinterlacing apparatus for converting an interlaced image into a progressive image, said apparatus comprising:

a frame memory for storing the interlaced image;

a filter unit for receiving, from said frame memory, a deinterlacing target field to be subjected to a deinterlacing process and one or both of forward and backward fields of the deinterlacing target field within the interlaced image, ~~from the frame memory,~~ and performing a filtering process to pixels of at least one of the received fields~~, thereby generating~~ so as to generate an interpolation pixel for the interlacing target field;

a difference operation unit for receiving, from said frame memory, the deinterlacing target field or a frame including the deinterlacing target field, and a field or frame which is adjacent to the deinterlacing target field or frame including the deinterlacing target field within the interlaced image~~, from the frame memory,~~ and operating a difference therebetween~~, thereby measuring~~ so as to measure a quantity of motion of the deinterlacing target field;

a filter coefficient setting unit for changing filter characteristics of ~~the~~ said filter unit based on ~~the basis of~~ the quantity of the motion measured by ~~the~~ said difference operation unit; and

a double-speed converter for composing the interlaced image and the interpolation pixel generated by ~~the~~ said filter unit, and generating the progressive image.

Claim 11 (Currently Amended) A deinterlacing method for performing a decoding process to a code sequence, field by field or frame by frame, which code sequence is

obtained by coding an interlaced image composed of plural fields using motion compensation, and converting a decoded image of the interlaced image, which is obtained by the decoding process, into a progressive image, said method comprising:

~~a decoding step of~~ decoding the interlaced image~~, thereby obtaining~~ so as to obtain the decoded image ~~as well as obtaining~~ and to obtain a motion vector at the motion compensation which indicates a prescribed reference field for a target field;

~~a motion vector conversion step of~~ converting a motion vector for each of the fields, having a size corresponding to a time interval between the target field and the prescribed reference field, into a motion vector of a size corresponding to a time interval of a fixed unit;

~~an inter-field interpolation pixel generation step of~~ obtaining pixels from reference fields which are forward and backward fields of a deinterlacing target field to be subjected to a deinterlacing process~~, on the basis of~~ based on the motion vectors converted in ~~the~~ said converting of the motion vector~~-conversion step~~, and generating a first interpolation pixel for the deinterlacing target field;

~~an intra-field interpolation pixel generation step of~~ generating a second interpolation pixel by using pixels in the deinterlacing target field;

~~a weighting factor decision step of~~ deciding a weighting factor which indicates a weighting ratio between the first interpolation pixel and the second interpolation pixel; and

~~a progressive image generation step of~~ obtaining a weighted mean of the first interpolation pixel and the second interpolation pixel by using the weighting factor decided in said deciding of the weighting factor ~~, thereby generating~~ so as to generate a third interpolation pixel, and interpolating the decoded image by using the third interpolation pixel~~,~~ so as to generate the progressive image.

Claim 12 (Currently Amended) A deinterlacing method for performing a decoding process to a code sequence, field by field or frame by frame, which code sequence is obtained by coding an interlaced image composed of plural fields using motion compensation, and converting an decoded image of the interlaced image, which is obtained by the decoding process, into a progressive image, said method comprising:

~~a decoding step of~~ decoding the interlaced image~~, thereby obtaining~~ so as to obtain the decoded image ~~as well as obtaining~~ and to obtain a motion vector at the motion compensation which indicates a prescribed reference field for a target field;

a ~~motion vector conversion step of~~ converting a motion vector for each of the fields having a size corresponding to a time interval between the target field and the prescribed reference field~~,~~ into a motion vector of a size corresponding to a time interval of a fixed unit;

~~a motion vector judgement step of~~ judging an effectiveness of the motion vectors converted in ~~the~~ said converting of the motion vector ~~conversion step~~;

~~an inter-field interpolation pixel generation step of~~ obtaining pixels from reference fields which are forward and backward fields of a deinterlacing target field to be subjected to a deinterlacing process~~,~~ based on ~~the basis of~~ the motion vectors converted in ~~the~~ said converting of the motion vector ~~conversion step~~ and a result of the ~~judgement~~ judgment in ~~the~~ said judging of the effectiveness of the motion vectors ~~judgement step~~, and generating a first interpolation pixel for the deinterlacing target field;

~~an intra-field interpolation pixel generation step of~~ generating a second interpolation pixel by using pixels in the deinterlacing target field;

~~a weighting factor decision step of~~ deciding a weighting factor which indicates a ~~weighing~~weighting ratio between the first interpolation pixel and the second interpolation pixel; and

~~a progressive image generation step of~~ obtaining a weighted mean of the first interpolation pixel and the second interpolation pixel by using the ~~weighing~~ weighting factor~~, thereby generating~~ so as to generate a third interpolation pixel, and interpolating the decoded image by using the third interpolation pixel~~,~~ so as to generate the progressive image.

Claim 13 (Currently Amended) The deinterlacing method of Claim 11 or 12, wherein the time interval of a fixed unit in ~~the~~ said converting of the motion vector ~~conversion step~~ is a time interval which is equivalent to one field.

Claim 14 (Currently Amended) The deinterlacing method of Claim 11 or 12, wherein processes in said generating of the first interpolation pixel~~the inter-field interpolation pixel generation step~~, the deciding of the weighting ~~weighing~~ factor ~~decision step~~ and ~~the~~ said obtaining of the weighted mean and interpolating of the decoded image so as to generate the progressive image ~~generation step~~ are carried out in units, which unit is smaller than a unit of an image accompanied by the motion vector at the motion compensation.

Claim 15 (Currently Amended) The deinterlacing method of Claim 11 or 12, wherein the code sequence is a code sequence which is coded by an MPEG method.

Claim 16 (Currently Amended) The deinterlacing method of Claim 11 or 12, wherein in ~~the~~ said converting of the motion vector, ~~conversion step,~~ when a distance between lines in a frame structure is one pixel, the motion vector is converted so that vertical components of the motion vector have an even number.

Claim 17 (Currently Amended) The deinterlacing method of Claim 12, wherein in said judging of the effectiveness of the motion vector, ~~judgement step,~~ when the size of the motion vector converted in ~~the motion vector conversion step~~ said converting of the motion vector is equal to or smaller than a predetermined value, the motion vector is judged to be effective.

Claim 18 (Currently Amended) The deinterlacing method of Claim 12, wherein in said judging of the effectiveness of the motion vector, ~~judgement step,~~ when a distance between lines in a frame structure is one pixel, a motion vector which has even-numbered vertical components from among the motion vectors converted in ~~the~~ said converting of the motion vector ~~conversion step~~ is judged to be effective.

Claim 19 (Currently Amended) The deinterlacing method of Claim 11, wherein in ~~the inter-field interpolation pixel generation step~~said obtaining of the pixels and generating of the first interpolation pixel, an evaluation scale for selecting an optimum motion vector

, for the generation of the first interpolation pixel is calculated by using the motion vectors converted in ~~the~~ said converting of the motion vector ~~conversion step~~, and the first interpolation pixel is generated by using a motion vector with which the best evaluation scale is obtained.

Claim 20 (Currently Amended) The deinterlacing method of Claim 11, wherein

in ~~the inter-field interpolation pixel generation step~~ said obtaining of the pixels and generating of the first interpolation pixel, an evaluation scale for selecting an optimum motion vector for the generation of the first interpolation pixel is calculated by using the motion vector converted in ~~the~~ said converting of the motion vector ~~conversion step~~ and a motion vector in the opposite direction to the motion vector, and the first interpolation pixel is generated by using a motion vector with which the best evaluation scale is obtained, and

the motion vector in the opposite direction is a motion vector which is in the opposite direction to the motion vector converted in ~~the~~ said converting of the motion vector, ~~conversion step~~ and indicates a reference field in an opposite forward/backward relationship to the reference field indicated by the motion vector with respect to the target field.

Claim 21 (Currently Amended) The deinterlacing method of Claim 12, wherein in ~~the inter-field interpolation pixel generation step~~ said obtaining of the pixels and generating of the first interpolation pixel, an evaluation scale for selecting, from among the motion vectors converted in said converting of the motion vector, an optimum motion vector for the generation of the first interpolation pixel is calculated by using a motion vector which is judged to be effective in ~~the~~ said judging of the effectiveness of the motion vectors ~~judgement step, among the motion vectors converted in the motion vector conversion step~~, and the first interpolation pixel is generated in said obtaining of the pixels and generating of the first interpolation pixel by using a motion vector with which the best evaluation scale is obtained.

Claim 22 (Currently Amended) The deinterlacing method of Claim 12, wherein

~~in the inter-field interpolation pixel generation step~~ said obtaining of the pixels and generating of the first interpolation pixel, an evaluation scale for selecting, from among the motion vectors converted in said converting of the motion vector, an optimum motion vector for the generation of the first interpolation pixel is calculated by using an effective motion vector which is judged to be effective in ~~the~~ said judging of the effectiveness of the motion vectors ~~judgement step~~ and a motion vector in the opposite direction to the effective motion vector, ~~among the motion vectors converted in the motion vector conversion step,~~ and the first interpolation pixel is generated in said obtaining of the pixels and generating of the first interpolation pixel by using a motion vector with which the best evaluation scale is obtained, and

the motion vector in the opposite direction is a motion vector which is in the opposite direction to the effective motion vector, and indicates a reference field in an opposite forward/backward relationship to the reference field indicated by the effective motion vector with respect to the target field.

Claim 23 (Currently Amended) The deinterlacing method of any one of Claims 19 to 22, wherein in ~~the inter-field interpolation pixel generation step~~ said obtaining of the pixels and generating of the first interpolation pixel, an evaluation scale for selecting an optimum motion vector for the generation of the first interpolation pixel is calculated by using the motion vector converted in ~~the~~ said converting of the motion vector ~~conversion step~~ and a motion vector having no motion, and the first interpolation pixel is generated in said obtaining of the pixels and generating of the first interpolation pixel by using a motion vector with which the best evaluation scale is obtained.

Claim 24 (Currently Amended) The deinterlacing method of any one of Claims 19 to 22, wherein the evaluation scale is a sum of absolute values of differences between pixels of the reference field which is indicated by the motion vector converted in ~~the~~ said converting of the motion vector ~~conversion step~~ and the second interpolation pixels.

Claim 25 (Currently Amended) The deinterlacing method of Claim 23, wherein the evaluation scale is a sum of absolute values of differences between pixels of the reference

field which is indicated by the motion vector converted in ~~the~~ said converting of the motion vector ~~conversion step~~ and the second interpolation pixels.

Claim 26 (Currently Amended) The deinterlacing method of any one of Claims 20 to 22, wherein the evaluation scale is a sum of absolute values of differences between pixels of the reference field which is indicated by the motion vector converted in ~~the~~ said converting of the motion vector ~~conversion step~~ and pixels of a reference field which is indicated by the motion vector in the opposite direction.

Claim 27 (Currently Amended) The deinterlacing method of any one of Claims 20 to 22, wherein

in ~~the inter-field interpolation pixel generation step~~ said obtaining of the pixels and generating of the first interpolation pixel, an evaluation scale for selection an optimum motion vector for the generation of the first interpolation pixel is calculated by using the motion vector converted in ~~the~~ said converting of the motion vector ~~conversion step~~ and a motion vector having no motion, and the first interpolation pixel is generated in said obtaining of the pixels and generating of the first interpolation pixel by using a motion vector with which the best evaluation scale is obtained, and

the evaluation scale is a sum of absolute values of differences between pixels of the reference field which is indicated by the motion vector converted in ~~the~~ said converting of the motion vector ~~conversion step~~ and pixels of the reference field which is indicated by the motion vector of the opposite direction.

Claim 28 (Currently Amended) A deinterlacing method for generating an interpolation pixel for an interlaced image which is composed of plural fields, using pixels in each of the fields, and converting the interlaced image into a progressive image, said method comprising:

~~an edge detection step of~~ detecting a direction indicated by a line passing through a position to be interpolated where the interpolation pixel is generated and connecting peripheral pixels of the position to be interpolated, as a direction of an edge;

~~an edge reliability decision step of~~ obtaining a strongness of a correlation between pixels existing in the direction of the edge, as a reliability of the edge; and

~~an interpolation pixel generation step of~~ generating the interpolation pixel by using the pixels existing in the direction of the edge when the reliability of the edge is equal to or larger than a predetermined value, and generating the interpolation pixel by using pixels existing in upper and lower directions of the position to be interpolated when the reliability of the edge is smaller than the predetermined value.

Claim 29 (Currently Amended) The deinterlacing method of Claim 11 or 12, wherein ~~the intra-field interpolation pixel generation step including~~ said generating of the second interpolation pixel includes:

~~an edge detection step of~~ detecting a direction indicated by a line passing through a position to be interpolated where the second interpolation pixel is generated, and connecting peripheral pixels of the position to be interpolated, as a direction of an edge;

~~an edge reliability decision step of~~ obtaining a strongness of a correlation between pixels existing in the direction of the edge, as a reliability of the edge; and

~~an interpolation pixel generation step of~~ generating the second interpolation pixel by using the pixels existing in the direction of the edge when the reliability of the edge is equal to or larger than a predetermined value, and generating the second interpolation pixel by using pixels existing in upper and lower directions of the position to be interpolated when the reliability of the edge is smaller than the predetermined value.

Claim 30 (Currently Amended) The deinterlacing method of Claim 28, wherein in ~~the edge reliability decision step~~ said obtaining of the strongness of the correlation between pixels existing in the direction of the edge, when a difference between the pixels existing in the direction of the edge is smaller than a difference between the pixels existing in the upper and lower directions of the position to be interpolated, the reliability of the edge is judged to be equal to or larger than the predetermined value.

Claim 31 (Currently Amended) The deinterlacing method of Claim 29, wherein in ~~the edge reliability decision step~~ said obtaining of the strongness of the correlation between

pixels existing in the direction of the edge, when a difference between the pixels existing in the direction of the edge is smaller than a difference between the pixels existing in the upper and lower directions of the position to be interpolated, the reliability of the edge is judged to be equal to or larger than the predetermined value.

Claim 32 (Currently Amended) The deinterlacing method of Claim 28, wherein in ~~the edge reliability decision step~~ said obtaining of the strongness of the correlation between pixels existing in the direction of the edge, when the interpolation pixel value which is obtained by using the pixels existing in the direction of the edge is a value between values of the pixels existing in the upper and lower directions of the position to be interpolated, the reliability of the edge is judged to be equal to or larger than the predetermined value.

Claim 33 (Currently Amended) The deinterlacing method of Claim 29 wherein in ~~the edge reliability decision step~~ said obtaining of the strongness of the correlation between pixels existing in the direction of the edge, when the interpolation pixel value which is obtained by using the pixels in the direction of the edge is a value between values of the pixels existing in the upper and lower directions of the position to be interpolated, the reliability of the edge is judged to be equal to or larger than the predetermined value.

Claim 34 (Currently Amended) The deinterlacing method of Claim 11 or 12, wherein for an intra-coded deinterlacing target image area in the deinterlacing target field, the deinterlacing process is performed in said obtaining of pixels from reference fields which are forward and backward fields of the deinterlacing target field by using a motion vector which accompanies a peripheral image area positioned around the deinterlacing target image area or an image area in a frame immediately preceding or immediately following the deinterlacing target field, which image area is at the same position as that of the deinterlacing target image area.

Claim 35 (Currently Amended) The deinterlacing method of Claim 11 or 12, wherein, when the code sequence which is decoded in ~~the~~ said decoding of the interlaced image

~~step~~ is recorded on a recording medium and read in a fast-forward or fast-rewind mode, the decoded image is interpolated by using only the second interpolation pixel generated in ~~the intra-field interpolation pixel generation step~~ said generating of the second interpolation pixel so as to generate ~~, thereby generating~~ the progressive image.

Claim 36 (Currently Amended) A deinterlacing apparatus for performing a decoding process to a code sequence obtained by coding an interlaced image which is composed of plural fields using motion compensation, field by field or frame by frame, and converting a decoded image of the interlaced image, which is obtained by the decoding process, into a progressive image, said apparatus comprising:

a decoder for decoding the interlaced image~~, thereby obtaining~~ so as to obtain the decoded image ~~as well as obtaining~~ and to obtain a motion vector at the motion compensation which indicates a prescribed reference field for a target field;

an image memory for storing the decoded image;

a parameter memory for storing the motion vector;

a motion vector converter for converting a motion vector for each of the fields, having a size corresponding to a time interval between the target field and the prescribed reference field, which is read from ~~the~~ said parameter memory, into a motion vector of a size corresponding to a time interval of a fixed unit;

an inter-field interpolation pixel generator for obtaining pixels from reference fields which are forward and backward fields of a deinterlacing target field to be subjected to a deinterlacing process~~,~~ based on ~~the basis of~~ the motion vectors converted by ~~the~~ said motion vector converter, and generating a first interpolation pixel for the deinterlacing target field;

an intra-field interpolation pixel generator for generating a second interpolation pixel by using pixels in the deinterlacing target field;

a ~~weighing~~ weighting factor decision unit for deciding a weighting factor which indicates a ~~weighing~~ weighting ratio between the first interpolation pixel and the second interpolation pixel; and

a progressive image generator for obtaining a weighted mean of the first interpolation pixel and the second interpolation pixel by using the weighting factor so as

to generate ~~, thereby generating~~ a third interpolation pixel, and interpolating the decoded image read from ~~the~~ said image memory by using the third interpolation pixel~~,~~ so as to generate the progressive image.

Claim 37 (Currently Amended) A deinterlacing apparatus for performing a decoding process to a code sequence obtained by coding an interlaced image which is composed of plural fields using motion compensation, field by field of frame by frame, and converting a decoded image of the interlaced image, which is obtained by the decoding process, into a progressive image, said apparatus comprising:

a decoder for decoding the interlaced image~~, thereby obtaining~~ so as to obtain the decoded image ~~as well as obtaining~~ and to obtain a motion vector at the motion compensation which indicates a prescribed reference field for a target field;

an image memory for storing the decoded image;

a parameter memory for storing the motion vector;

a motion vector converter for converting a motion vector for each of the fields, having a size corresponding to a time interval between the target field and the prescribed reference field, which is read from ~~the~~ said parameter memory, into a motion vector of a size corresponding to a time interval of a fixed unit;

a motion vector ~~judgement~~ judgment unit for judging an effectiveness of the motion vectors converted by ~~the~~ said motion vector converter;

an inter-field interpolation pixel generator for obtaining pixels from reference fields which are forward and backward fields of a deinterlacing target field to be subjected to a deinterlacing process based~~,~~ on ~~the basis of~~ the motion vectors converted by ~~the~~ said motion vector converter and a result of the ~~judgement~~ judgment by ~~the~~ said motion vector ~~judgement~~ judgment unit, and generating a first interpolation pixel for the deinterlacing target field;

an intra-field interpolation pixel generator for reading pixels in the deinterlacing target field so as to generate a second interpolation pixel;

a weighting factor decision unit for deciding a weighting factor which indicates a weighting ratio between the first interpolation pixel and the second interpolation pixel; and

, a progressive image generator for obtaining a weighted mean of the first interpolation pixel and the second interpolation pixel by using the weighting factor~~,~~ ~~thereby generating~~ so as to generate a third interpolation pixel, and interpolating the decoded image read from ~~the~~ said image memory by using the third interpolation pixel~~,~~ so as to generate the progressive image.